DOCUMENT RESUME

ED 364 742 CE 065 307

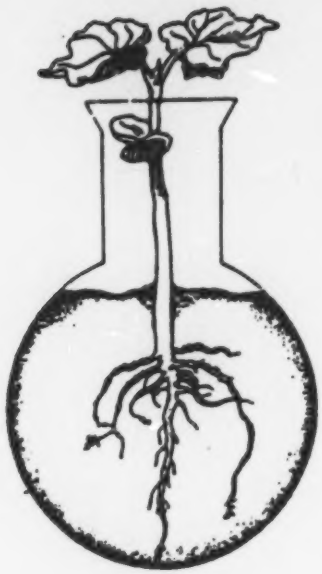
TITLE	Sexual Plant Reproduction. Agricultural Lesson Plans.
INSTITUTION	Southern Illinois Univ., Carbondale. Dept. of Agricultural Education and Mechanization.
PUB DATE	92
NOTE	38p.; For related documents, see CE 065 306-311.
PUB TYPE	Guides - Classroom Use - Teaching Guides (For Teacher) (052)
EDRS PRICE	MF01/PC02 Plus Postage.
DESCRIPTORS	*Agricultural Education; Behavioral Objectives; Learning Activities; Lesson Plans; *Plant Growth; *Plant Propagation; *Reproduction (Biology); Secondary Education
IDENTIFIERS	*Germination; *Seeds

ABSTRACT

These lesson plans are intended for use in conducting classes on sexual plant reproduction. Presented first are an attention step/problem statement and a series of questions and answers designed to convey general information about sexual plant reproduction/propagation. The following topics are among those discussed: sexual and asexual plant propagation, seeds and seed parts, types of seeds, monocot and dicot seeds, germination, stages of germination, seedling parts, environmental conditions needed for germination, plant media, germination rate, planting depth, and the relationship between soil temperature and planting depth. Also provided are the following: a glossary of pertinent scientific terms, 3 worksheets, answers to the worksheets, a quiz and quiz answers, 14 overhead transparency masters, and lesson plans for teaching students to test seed for germination percentage and sow seeds. Each lesson plan includes an objective, list of equipment needed, student activity record sheet, and detailed steps for completing the activity. (MN)

****
* Reproductions supplied by EDRS are the best that can be made *
* from the original document. *
****

ED 364 742



Agricultural Lesson Plans

SEXUAL PLANT REPRODUCTION

U.S. DEPARTMENT OF EDUCATION
Office of Educational Research and Improvement
EDUCATIONAL RESOURCES INFORMATION CENTER (ERIC)

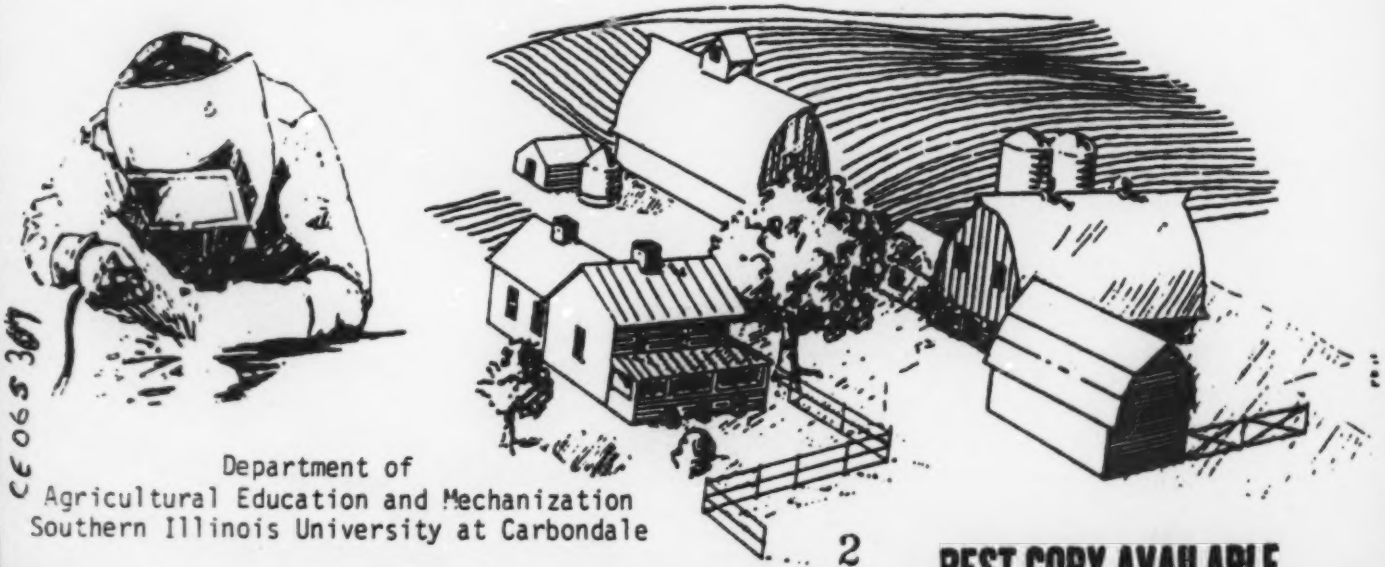
This document has been reproduced as received from the person or organization originating it.

Minor changes have been made to improve reproduction quality.

Points of view or opinions stated in this document do not necessarily represent official OERI position or policy.

"PERMISSION TO REPRODUCE THIS MATERIAL HAS BEEN GRANTED BY

TO THE EDUCATIONAL RESOURCES INFORMATION CENTER (ERIC)."



CE 065 307

Department of
Agricultural Education and Mechanization
Southern Illinois University at Carbondale

BEST COPY AVAILABLE

SEXUAL PLANT REPRODUCTION

ATTENTION STEP/PROBLEM STATEMENT

Have popcorn popping when students arrive for class or pop the popcorn before class starts. The students can eat the popcorn while you discuss seeds.

All seeds have 3 parts: the outside seed coat, the young plant inside the seed, and a stored food supply. Dicot plants and monocot plants store food for emerging seedlings differently. Dicots store the food for the seedlings in the seed leaves (cotyledons). Monocots store their food inside the seed and it is called endosperm. In fact the popcorn we eat is actually endosperm.

General Information about Sexual Reproduction of Plants

1. What are two means of propagation for plants ?
   - Plants are propagated either sexually or asexually.

2. Define sexual propagation ?
   - Sexual reproduction of plants involves the union of male and female sex cells. The formation of seeds is the result of the sexual union of plants.

3. What is the definition of asexual plant reproduction ?
   In asexual reproduction, there are no sex cells involved and the offspring has only one parent. The offspring is formed by division from a cell or group of cells coming from only one parent, so the offspring has the same genes as the parent. New plants have the same chromosomes as the parent plant, so plants are identical and do not vary genetically.

4. Why are sexual offspring different from the parent plant ?
   - The offspring of sexually reproduced plants have genes from 2 parents and has a new gene combination. The offspring are not identical to either parent.

5. How are sexually produced plants propagated ?
   - Sexually reproduced plants are propagated by seed.

6. What is the definition of a seed ?
   A seed is a ripened ovule of a plant.

7. What are three parts of all seeds ?
   - All seeds contain an embryo, an outside seed coat, and a stored food supply. The embryo is the young plant inside the seed. The outside seed coat protects the embryo from the environment while the seed is still dormant. The stored food supply may be found in the endosperm or in the cotyledons.

8. What are the two types of plant seeds ?
   - The two types of plant seed are monocot and dicot. They germinate differently.

9. What are some important characteristics of monocot seeds ?
   - Monocots have one seed leaf known as a cotyledon. Food for the embryo to use during germination is stored in the endosperm of the seed.

10. What are some important characteristics of dicot seeds ?
   - Dicots have two cotyledons. Food for the embryo to use during germination is stored in the cotyledons.

11. What is germination ?
   Seed germination is the changes undergone by a seed immediately before and including the first signs of growth.

12. What are the three stages of germination ?
   There are 3 stages of seed germination: the awakening stage, the digesting stage and seedling growth stage.

13. What occurs during the awakening stage ?
   The awakening stage of the seed starts with the absorption of water by the dry seed. The seed swells. The essential living matter of the plant cell called protoplasm becomes hydrated. Enzyme activity begins in the embryo. The DNA, RNA, and ATP in the embryo are activated. DNA is the substance of which genes are made. RNA is needed for copying genetic information during protein synthesis. ATP is the major energy transferring molecule in biological systems and is essential for the synthesis of DNA and RNA. The cells that form the radicle elongate and the radicle emerges from the seed. The radicle forms the primary root.

14. What occurs in the digestive stage ?
   In the Digesting Stage the fats, proteins, and carbohydrates that are stored in the endosperm (monocots) or cotyledons (dicots) are digested by the seed embryo. The digested food moves to the growing points of the embryo. The seed continues to take up water. The oxidative breakdown of food substances within the cells of the embryo occurs. This process is called respiration. Enzyme activity continues.

15. What occurs during the seedling stage ?
   Cell division and the expansion of the seedling structures occur during the seedling stage. A seedling is a young plant that is forming roots, stems, and leaves. The seedling begins to develop. Respiration rate increases with growth. Water absorption increases as the radicle and new roots take up water. The upper part of the seedling pokes through the soil and emerges at the surface. The following parts of the seedling are present soon after emergence:

16. What is the Coleoptile ?
    - sheathlike structure that protects the epicotyl in germinating monocot seed.

17. What is the Epicotyl ?
    - forms the stem above the cotyledon.

18. What is the Hypocotyl ?
    - forms the stem below the cotyledon.

19. Do seeds need a rest period before germination ?
    Yes, Most seeds need a period of dormancy, or required rest period, before they can germinate.

20. Where is the seeds stored food supply usually found ?
    The stored food supply may be found in the endosperm or in the cotyledons, depending on the type of seed.

21. What are three and sometimes four Environmental Conditions Needed for Germination ?

    - Seeds require the proper amount of oxygen, water, temperature, and sometimes light to germinate. These requirements differ with each plant species. Each specific plant species has specific germination requirements.

22. What are three important characteristics of plant media ?
    - Many different types of media are used in seed propagation. Media must be able to retain moisture, allow for drainage, and be free of diseases.

23. What are some of the more common items used for plant media ?
    - Common media used for seed germination include:
      - soilless potting soil mix, usually containing peat moss and vermiculite,
      - vermiculite,- sphagnum moss,- peat moss, and foam.

24. What is the term used to describe the number of living seeds?
    - The difference between the number of viable seed and seed that is not viable is called germination percentage. Seeds may live a long time until conditions are favorable for germination and development.

25. How is the seed germination rate determined ?

    - Figure germination percentage as follows:
      Number of seedling that emerged divided by the number of seeds planted = _____ X 100 = _____%

How Planting Depth Affects Seed Germination

26. Generally, how deep should seeds be planted ?
    - As a general rule, seeds are planted to a depth of 3-4 times their diameter.

27. What is affected by planting depth ?
    - The depth a seed is planted in the soil may effect the amount of oxygen available, the amount of water available, its temperature, and amount of light available.

28. What problems may be caused by improper planting depth ?
    - The planting of seeds too deep may be one cause of poor aeration. Seeds may dry out if planted too shallow.

29. What are the general temperature requirements for seeds ?
    - Some plant species require either cool temperatures or warm temperatures for seeds to germinate. Others require the temperature to fluctuate from warm to cold for seed germination.

30. How is soil temperature and planting depth related ?
    - Planting depth can effect temperature. Seeds that are planted too deep in the early spring can suffer from cool temperatures.

GLOSSARY OF SCIENTIFIC TERMS:

ATP -	the major energy transferring molecule in biological systems and essential for the synthesis of DNA and RNA.
coleoptile -	sheathlike structure that protects the epicotyl in germinating monocot seed.
cotyledons -	(seed leaves) the first leaf or leaves of the embryo in seed plants.
dicots -	plants having embryos with two cotyledons.
DNA -	the substance of which genes are made.
dormancy -	a period of rest required by most seeds before they can germinate.
embryo -	young plant inside a seed.
endosperm -	part of seed where food is stored in monocots.
epicotyl -	forms the stem above the cotyledon.
genes -	the unit of inheritance found on chromosomes.

germination -	the changes undergone by a seed immediately before and including the first signs of growth.
hypocotyl -	forms the stem below the cotyledon.
media -	material in which a plant is grown. Example: soil.
monocots -	plants having embryos with one cotyledon (seed leaf).
plant species -	a distinct kind of plant.
propagation -	multiplication of plants by both sexual and asexual methods.
protoplasm -	essential living matter of plant and animal cells.
radicle -	forms the primary root.
respiration -	the oxidative breakdown of food substances within the cells of plants and other living organisms.
RNA -	needed for copying genetic information during protein synthesis.
seed -	the ripened ovule in seed plants; contains embryo, outside seed coat, and stored food supply.
seed coat -	covering of a seed that protects the embryo.
seedling -	a young plant that is forming roots, stems, and leaves.
sexual reproduction -	the formation of offspring of a species by the union of two cells.
viable -	seeds that are able to germinate and grow.

WORK SHEET A

Directions: Complete the following questions.

1. Plants that reproduce sexually have _____ parent(s), while plants that reproduce asexually have_____ parent(s).

2. The formation of _____ is the result of the sexual union of plants.

3. Sexually reproduced plants are propagated by _____.

4. The three parts of a seed are:
   a. _____
   b. _____
   c. _____

5. The two types of plant seed are _____ and _____.

6. Monocots have_____cotyledon(s) and food for the embryo is stored in the _____.

7. Dicots have _____ cotyledon(s) and food for the embryo is stored in the _____.

8. Four environmental conditions necessary for seed germination are:
   a. _____
   b. _____
   c. _____
   d. _____

9. The difference between the number of viable seed and seed that is not viable is called _____.

10. As a general rule, seeds are planted at a depth of _____ times their diameter.

WORK SHEET A ANSWERS

Directions: Complete the following questions.

1. Plants that reproduce sexually have ___2___ parent(s), while plants that reproduce asexually have___1___ parent(s).

2. The formation of ___*seeds*___ is the result of the sexual union of plants.

3. Sexually reproduced plants are propagated by ___*seed*___.

4. The three parts of a seed are:
   a. ___*embryo*___
   b. ___*seed coat*___
   c. ___*stored food supply*___

5. The two types of plant seed are ___*monocot*___ and ___*dicot*___.

6. Monocots have___*1*___cotyledon(s) and food for the embryo is stored in the ___*endosperm*___.

7. Dicots have ___*2*___ cotyledon(s) and food for the embryo is stored in the ___*cotyledons*___.

8. Four environmental conditions necessary for seed germination are:
   a. ___*oxygen*___
   b. ___*water*___
   c. ___*suitable temperatures*___
   d. ___*sometimes light*___

9. The difference between the number of viable seed and seed that is not viable is called ___*germination percentage*___.

10. As a general rule, seeds are planted at a depth of ___*3-4*___ times their diameter.

WORK SHEET B

Directions:

The answers to the following fill-in-the blank questions are terms which have something to do with sexual reproduction. Choose the term from the word list below that best answers each question. Each term may be used only once.

Word List:

ATP
coleoptile
cotyledons
dicots
DNA
dormancy
embryo
endosperm
epicotyl
genes
germination
hypocotyl
media
monocots
plant species
propagation
protoplasm
radicle
respiration
RNA
seed
seed coat
seedling
sexual reproduction
viable

Fill-in-the-blank:

1. The formation of offspring of a species by the union of two cells is called _____.

2. The unit of inheritance found on chromosomes is called _____.

3. A _____ is a ripened ovule containing an embryo, seed coat, and a stored food supply.

4. An _____is the young plant inside a seed.

5. A _____is a covering that protects the embryo.

6. _____is the changes undergone by a seed immediately before and including the first signs of growth.

7. _____is the period of rest required by most seeds before they can germinate.

8. Seeds that are able to germinate and grow are called _____.

9. The first leaves of the embryo during germination are called _____.

10. Seed that have embryos with two cotyledons are called _____.

11. Seed that have embryos with one cotyledon are called _____.

12. The food of a monocot seed is stored in the _____.

13. _____is the multiplication of plants by both sexual and asexual methods.

14. A young plant that is forming roots, stems, and leaves is called a _____.

15. A distinct kind of plant is known as a _____.

16. Plants are grown in _____.

17. The _____forms the stem above the cotyledon on the germinating seedling.

18. The _____ forms the stem below the cotyledon on the germinating seedling.

19. The _____ forms the primary root.

20. The _____ protects the seed in the germinating monocot seedling.

21. Genes are made of _____.

22. _____ is needed for copying genetic information during protein synthesis.

23. _____ is essential for the synthesis of DNA and RNA.

24. _____ is the essential living matter of all living things.

25. The oxidative breakdown of food substances within the cells of plants and other living organisms is called _____.

WORK SHEET B ANSWERS

Directions:

The answers to the following fill-in-the blank questions are terms which have something to do with sexual reproduction. Choose the term from the word list below that best answers each question. Each term may be used only once.

Word List:

ATP
coleoptile
cotyledons
dicots
DNA
dormancy
embryo
endosperm
epicotyl
genes
germination
hypocotyl
media
monocots
plant species
propagation
protoplasm
radicle
respiration
RNA
seed
seed coat
seedling
sexual reproduction
viable

Fill-in-the-blank:

1. The formation of offspring of a species by the union of two cells is called *sexual reproduction*.
2. The unit of inheritance found on chromosomes is called *genes*.
3. A *seed* is a ripened ovule containing an embryo, seed coat, and a stored food supply.
4. An *embryo* is the young plant inside a seed.
5. A *seed coat* is a covering that protects the embryo.
6. *Germination* is the changes undergone by a seed immediately before and including the first signs of growth.
7. *Dormancy* is the period of rest required by most seeds before they can germinate.

8. Seeds that are able to germinate and grow are called *viable*.

9. The first leaves of the embryo during germination are called *cotyledons*.

10. Seed that have embryos with two cotyledons are called *dicots*.

11. Seed that have embryos with one cotyledon are called *monocots*.

12. The food of a monocot seed is stored in the *endosperm*.

13. *Propagation* is the multiplication of plants by both sexual and asexual methods.

14. A young plant that is forming roots, stems, and leaves is called a *seedling*.

15. A distinct kind of plant is known as a *plant species*.

16. Plants are grown in *media*.

17. The *epicotyl* forms the stem above the cotyledon on the germinating seedling.

18. The *hypocotyl* forms the stem below the cotyledon on the germinating seedling.

19. The *radicle* forms the primary root.

20. The *coleoptile* protects the seed in the germinating monocot seedling.

21. Genes are made of *DNA*.

22. *RNA* is needed for copying genetic information during protein synthesis.

23. *ATP* is essential for the synthesis of DNA and RNA.

24. *Protoplasm* is the essential living matter of all living things.

25. The oxidative breakdown of food substances within the cells of plants and other living organisms is called *respiration*.

WORK SHEET C

DIRECTIONS: Complete the following questions.

A. Fill-in-the-Blank:

The Awakening Stage

1. Seed germination begins with the absorption of _____ by the dry seed. The seed swells and the _____ in the seed becomes hydrated.

2. _____ activity begins in the embryo and DNA, RNA, and ATP are activated.

3. After cells _____, the radicle emerges from the seed.

The Digesting Stage

4. The stored fats, proteins, and carbohydrates are _____ by the seed embryo and moved to its growing points.

5. The embryo continues to take up water, and_____ and enzyme activity continues.

Seedling Growth Stage

6. The cells _____ and the expansion of the seedling structures occur.

7. _____ rate increases with growth and water absorption increases as the _____take up water.

WORK SHEET C ANSWERS

DIRECTIONS: Complete the following questions.

A. Fill-in-the-Blank:

The Awakening Stage

1. Seed germination begins with the absorption of *water* by the dry seed. The seed swells and the *protoplasm* in the seed becomes hydrated.

2. *Enzyme* activity begins in the embryo and DNA, RNA, and ATP are activated.

3. After cells *elongate*, the radicle emerges from the seed.

The Digesting Stage

4. The stored fats, proteins, and carbohydrates are *digested* by the seed embryo and moved to its growing points.

5. The embryo continues to take up water, and *respiration* and enzyme activity continues.

Seedling Growth Stage

6. The cells *divide* and the expansion of the seedling structures occur.

7. *Respiration* rate increases with growth and water absorption increases as the *radicle or roots* take up water.

Demonstrate testing seed for germination percentage to the class.

Activity Summary: **(Students will work in groups of 2 and test bean and popcorn seeds.) Show students where to write their names on the petri dishes using a waterproof marker. Place 2 pieces of filter paper in the bottom of petri dish. Count 10 bean seeds and place on top of filter paper. Cover with another piece of filter paper. Demonstrate wetting paper with water and pouring off excess water. Repeat this process with the popcorn seed.**

TESTING SEED

a. Purpose:

to test the viability of the seed.
to observe germinating dicot and monocot seed.

b. What Each Student Needs:

Two plastic petri dishes
Six pieces of filter paper
10 popcorn seeds
10 bean seeds
waterproof marker
water

c. Here's How:

1. Have students work in groups of 2.
2. Each group should get 2 petri dishes, 6 pieces of filter paper, 10 popcorn seeds, and 10 bean seeds.
3. Write your names on the petri dishes with the waterproof marker.
4. Place 2 pieces of filter paper in each petri dish.
5. Put 10 popcorn seeds in one of the petri dishes and 10 bean seeds in the other petri dish.
6. Cover the seeds with a piece of filter paper.
7. Soak the filter paper thoroughly with water.
8. Pour off all excess water.
9. Place petri dish where instructed by your teacher.
10. Add water when needed.
11. Observe the seeds daily for 2 weeks and record observations on Student Activity - 1 Record Sheet.

STUDENT - RECORD SHEET

POPCORN SEEDS		BEAN SEEDS	
Date	Number of Seeds That Have Germinated	Date	Number of Seeds That Have Germinated
_____	_____	_____	_____
_____	_____	_____	_____
_____	_____	_____	_____
_____	_____	_____	_____
_____	_____	_____	_____
_____	_____	_____	_____
_____	_____	_____	_____
_____	_____	_____	_____
_____	_____	_____	_____
_____	_____	_____	_____

Figure Germination Percentage of Popcorn Seeds:

Number of seedling germinated / 10 = _____ X 100 = _____%.

Figure Germination Percentage of Bean Seeds:

Number of seedling germinated / 10 = _____ X 100 = _____%.

Demonstrate sowing seed to the class.

Activity Summary: ***Show students where to write their names on pots with a waterproof marker. Number the pots 1 - 4. Students will be planting 20 popcorn seed and 20 bean seed. Five seed of each will be planted at different depths in 4 different pots. In pot #1, the seed will be planted very deep and in pot # 4, the seed will be laid on top of the medium. The pots will be watered and observed for at least 2 weeks.***

COMPARISON OF DEPTH OF SOWING

a. Purpose: to understand the importance planting depth has on seedling emergence and to compare the differences between monocot and dicot germination

b. What Each Student Needs:

Four 6" standard pots
20 popcorn seeds
20 bean seeds
media
waterproof marker

c. Here's How:

1. Get 20 popcorn seed, 20 bean seeds, and four 6" pots from your teacher.
2. Write your name on the pots and number the pots 1-4 with a waterproof marker.
3. Put one inch of media in the 1st pot. Put 5 popcorn seeds and 5 bean seeds on top of media. Finish filing the pot with media.
4. Put 3 inches of media in the 2nd pot. Put 5 popcorn seeds and 5 bean seeds on top of media. Finish filling the pot with media.
5. Put 5 inches of media in the 3rd pot. Put 5 popcorn seeds and 5 bean seeds on top of media. Finish filling the pot with media.
6. Fill 4th pot completely full with media. Lay 5 popcorn seeds and 5 bean seeds on top of media.
7. Water the seeds.
8. Clean up your work area.
9. Water pots as needed.
10. Observe pots at least twice a week.
11. Record results on activity record sheet.

The student Activity Record Sheet will take at least 2 weeks to complete.

RECORD SHEET

POPCORN SEEDS

A. Sketch the germinating popcorn seed.

B. Is popcorn a monocot or is it a dicot?

C. Record the Number of popcorn seedlings as they emerge on the table below.

Date	Pot #1	Pot #2	Pot #3	Pot#4
_____	_____	_____	_____	_____
_____	_____	_____	_____	_____
_____	_____	_____	_____	_____
_____	_____	_____	_____	_____

D. Figure the popcorn germination percentages for the 4 pots using the table below.

Pot 1 _____ / 5 = _____ X 100 = _____%

Pot 2 _____ = _____%

Pot 3 _____ = _____%

Pot 4 _____ = _____%

E. Compare the rate the seedlings emerged.

1. In which pots did the corn seedlings emerge the quickest?

2. In which pots did the corn seedlings emerge the slowest?

SOYBEAN SEEDS

A. Sketch the germinating soybean seed.

B. Is soybean a monocot or is it a dicot?

C. Record the Number of soybean seedlings as they emerge on the table below.

Date	Pot #1	Pot #2	Pot #3	Pot#4
_____	_____	_____	_____	_____
_____	_____	_____	_____	_____
_____	_____	_____	_____	_____
_____	_____	_____	_____	_____

D. Figure the soybean germination percentages for the 4 pots using the table below.

Pot 1 _____ / 5 = _____ X 100 = _____%

Pot 2 _____ = _____%

Pot 3 _____ = _____%

Pot 4 _____ = _____%

E. Compare the rate the seedlings emerged.

1. In which pots did the soybean seedlings emerge the quickest?

2. In which pots did the soybean seedlings emerge the slowest?

Discuss the Student Activity with the class. Review how to calculate germination percentages.

Students should check their seedlings twice a week for at least 2 weeks. This activity may take 3 weeks. Observations should be recorded on the Student Activity - 2 Record Sheet. The activity should be discussed by the class at the completion of the activity.

Quiz

A. Matching:

Match the best definition with each term.

____1.	Dicot	a.	forms the stem below the cotyledon.
____2.	Monocot	b.	the first leaves of the embryo in seed plants.
____3.	Sexual Reproduction	c.	forms the primary root of a seedling.
____4.	Epicotyl	d.	seeds having embryos with two cotyledons.
____5.	Hypocotyl	e.	formation of offspring of a species by the union of 2 cells.
____6.	Cotyledon	f.	type of seed that stores its food in the endosperm.
____7.	Radicle	g.	forms the stem above the cotyledon.

B. True or False:

_____ 8. Seeds are generally planted at a depth of 2 times their diameter.

_____ 9. The depth a seed is planted can affect the amount of water and oxygen it receives.

_____ 10. The stem emerges from the seed before the radicle during seed germination.

_____ 11. The difference between the number of live seed and dead seed is called germination percentage.

C. Fill-in-the-blank:

12. Sexually reproduced plants are propagated by _____.

13. If you planted 10 seeds and only 7 seeds germinated, the germination percentage would be _____.

14. The awakening stage of the seed starts with the absorption of _____by the dry seed.

15. Name three environmental conditions that affect seed germination.
    a.
    b.
    c.
    d.

16. Name the three parts of a seed.
    a.
    b.
    c.

Quiz Answers

A. Matching:

Match the best definition with each term.

d 1. Dicot

f 2. Monocot

e 3. Sexual Reproduction

g 4. Epicotyl

a 5. Hypocotyl

b 6. Cotyledon

c 7. Radicle

a. forms the stem below the cotyledon.

b. the first leaves of the embryo in seed plants.

c. forms the primary root of a seedling.

d. seeds having embryos with two cotyledons.

e. formation of offspring of a species by the union of 2 cells.

f. type of seed that stores its food in the endosperm.

g. forms the stem above the cotyledon.

B. True or False:

False 8. Seeds are generally planted at a depth of 2 times their diameter.

True 9. The depth a seed is planted can affect the amount of water and oxygen it receives.

False 10. The stem emerges from the seed before the radicle during seed germination.

True 11. The difference between the number of live seed and dead seed is called germination percentage.

C. Fill-in-the-blank:

12. Sexually reproduced plants are propagated by *seed*.

13. If you planted 10 seeds and only 7 seeds germinated, the germination percentage would be *70%*.

14. The awakening stage of the seed starts with the absorption of *water* by the dry seed.

15. Name three environmental conditions that affect seed germination.
    a. *Temperature*
    b. *Amount of oxygen*
    c. *Amount of water*
    d. *Sometimes the amount of light*

16. Name the three parts of a seed.
    a. *Embryo*
    b. *Seed Coat*
    c. *A Stored Food Supply*

OH1

PARTS OF A SEED

Embryo

Outside seed coat

Stored food supply

OH2

TWO TYPES OF PLANT SEED

Monocot

Dicot

OH3

CHARACTERISTICS

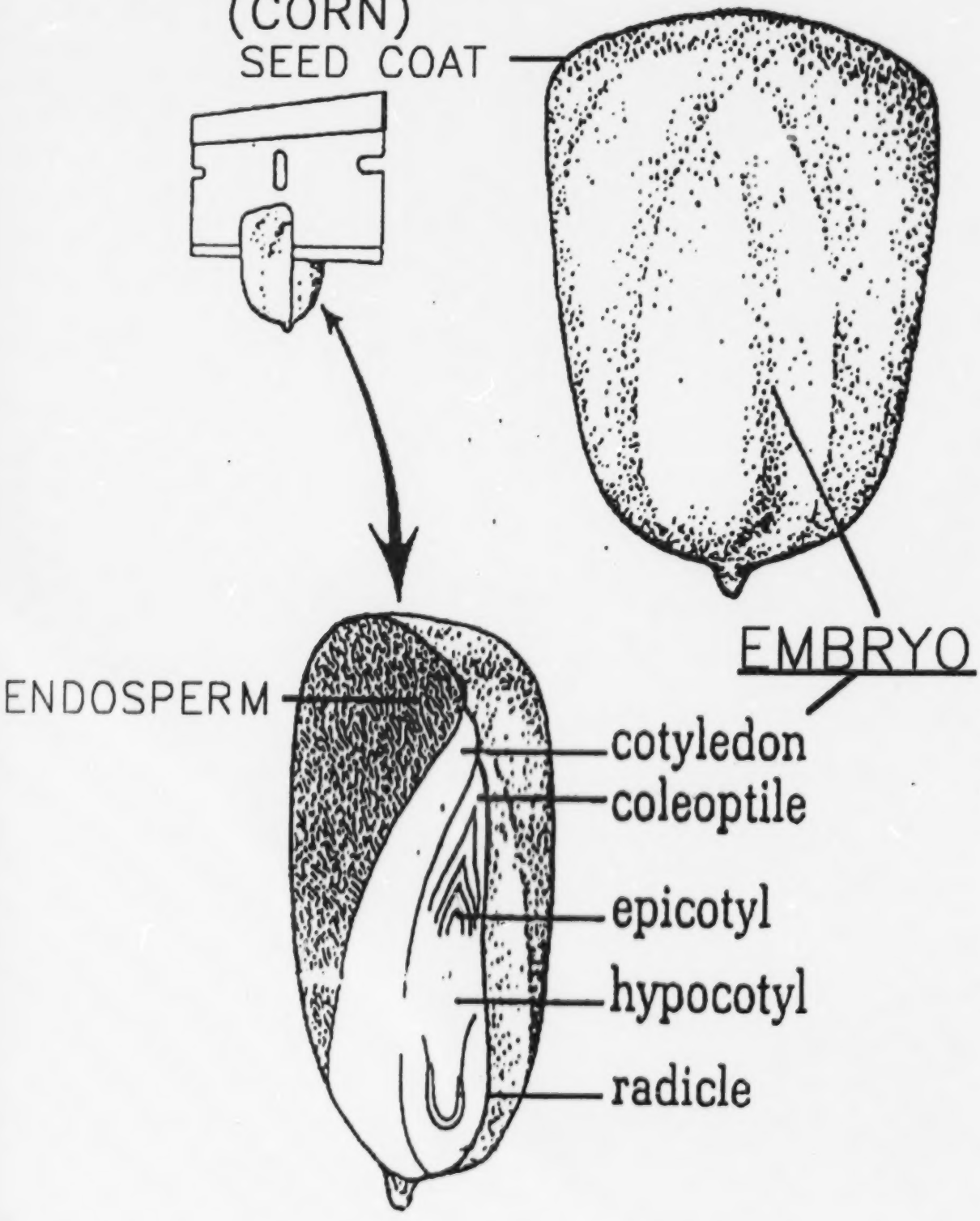
OF MONOCOTS:

One seed leaf

Food stored in the endosperm

OH4

MONOCOT SEED (CORN)



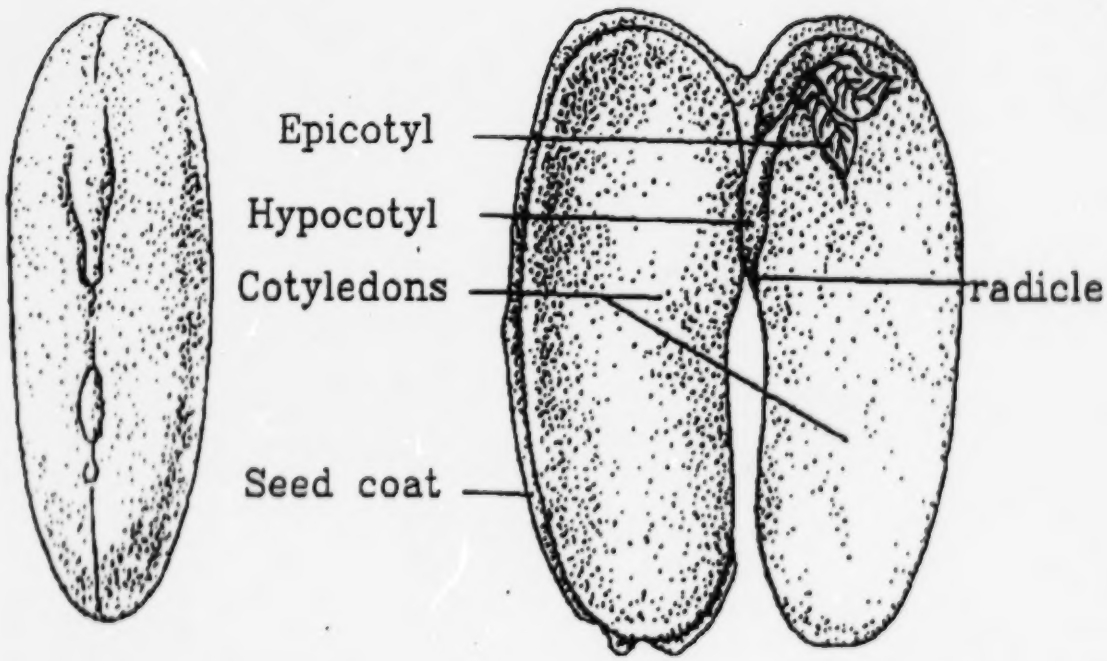
OH5

CHARACTERISTICS

OF DICOTS:

Two seed leaves

Food stored in the cotyledons



A DICOT SEED
(BEAN)

OH7

ENVIRONMENTAL CONDITIONS NEEDED FOR GERMINATION:

Optimum Oxygen

Optimum Water

Optimum Temperature

Sometimes - Light

OH8

MEDIA FOR

SEED GERMINATION:

Soil
Soilless mix
Vermiculite
Sphagnum moss
Peat moss
Foam

OH9

FIGURING GERMINATION

PERCENTAGE:

Number of seedlings that have emerged divided by Number of seeds planted =

_____ X 100 =

_____ % germination

OH10

GENERAL RULE ABOUT

PLANTING DEPTH:

Plant seed at a depth of
3 - 4 times the diameter
of the seed.

OH11

THREE STAGES OF SEED GERMINATION:

Awakening Stage

Digesting Stage

Seedling Growth Stage

OH12

AWAKENING STAGE

Absorption of water.

Enzyme activity begins.

Cells elongate and radicle emerges.

OH13

DIGESTING STAGE

Stored food is digested
and moved to growing points
of the embryo.

OH14

SEEDLING GROWTH

Cell division and expansion of the seedling structures occur.